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The MARQUIS OF NORTHAMPTON, President, in the Chair.

"Memoir on the Rotation of Crops, and on the Quantity of Inorganic Matters abstracted from the Soil by various plants under different circumstances." By Charles G. B. Daubeny, M.D., F.R.S., Professor of Rural Economy, &c. in the University of Oxford.

The author was first led to undertake the researches of which an account is given in the present memoir, by the expectation of verifying the theory of De Candolle, in which the deterioration experienced by most crops on their repetition was attributed to the deleterious influence of their root-excretions. For this purpose he set apart, ten years ago, a number of plots of ground in the Botanic Garden at Oxford, uniform as to quality and richness, one-half of which was planted each year, up to the present time, with the same species of crop, and the other half with the same kinds, succeeding each other in such a manner that no one plot should receive the same crop twice during the time of the continuance of the experiments, or at least not within a short period of one another. The difference in the produce obtained in the two crops, under these circumstances, would, the author conceived, represent the degree of influence ascribable to the root-excretions.

The results obtained during the first few years from these experiments, as well as from the researches which had, in the mean time, been communicated to the world by M. Braconnot and others on the same subject, led him in a great measure to abandon this theory, and to seek for some other mode of explaining the falling-off of crops on repetition. In order to clear up the matter, he determined to ascertain, for a series of years, not only the amount of crop which would be obtained from each of the plants tried under these two systems, but also the quantity of inorganic matters extracted in each case from the soil, and the chemical constitution of the latter, which had furnished these ingredients. The chemical examination of the crops, however, on account of the labour it involved, was confined to six out of the number of the plants cultivated; and of these, three

samples were analysed; the first being the permanent one, viz. that cultivated for nine or ten successive years in the same plot of ground; the second, the shifting one, obtained from a plot which had borne different crops in the preceding years; and the third, the standard, derived from a sample of average quality, grown under natural circumstances, either in the Botanic Garden itself, or in the neighbourhood of Oxford. These analyses were performed by Mr. Way formerly assistant to Professor Graham, of University College, London, and now attached to the Agricultural College near Cirencester.

The examination of the soils was carried on in two ways; the first, with the view of estimating the entire amount of their available ingredients; and the second, with that of ascertaining the quantity in a state to be taken up at once by plants, the available ingredients being those which are soluble in muriatic acid; the active ones, those which are taken up by water impregnated with carbonic acid gas. This portion of the investigation was conducted in part by the author, and in part by Mr. Way, and has reference to three subjects; first, to the amount of produce obtained from the deficient crops; secondly, to their chemical constitution; and thirdly, to the nature of the soil in which the crops were severally grown.

The plants experimented upon were spurge, potatoes, barley, turnips, hemp, flax, beans, tobacco, poppies, buckwheat, clover, oats, beet, mint, endive, and parsley. The only crop which seemed to show the influence of root-excretions was *Euphorbia Lathyris*, which would not grow in the same ground three years successively, although the soil was found afterwards fitted for rearing several other species of plants. In the remaining cases, there was in general a marked difference between the permanent and the shifting crop, to the disadvantage of the former; and where exceptions occurred to this rule, they seemed capable of being accounted for by accidental causes. The amount of each year's crop is given in a tabular form, and their differences illustrated by diagrams showing the relation between the two crops of each vegetable.

The second part of the memoir commences with an account of the method of analysis pursued by the author for determining the nature and proportions of the ingredients present in the ashes of the crops submitted to examination. This method was, in general, similar to that recommended by Will and Fresenius in their paper published in the 'Philosophical Magazine,' No. 169; but in determining the amount of phosphoric acid, the following mode was adopted in preference to the one therein given.

As the phosphoric acid would seize upon the iron in preference to any other base, the amount of peroxide of iron present in the ash was first determined by precipitating it from a muriatic solution by means of acetate of ammonia. The weight of the precipitate gives that of phosphate of iron, from which that of the peroxide of iron may be readily calculated. This being ascertained, he proceeds to determine the phosphoric acid by operating on a fresh portion of the solution of the ash, into which a certain known weight of iron

dissolved in muriatic acid is introduced, in quantity more than sufficient to unite with the whole of the phosphoric acid present. This done, acetate of ammonia is added and the mixture boiled, when all the peroxide of iron, whether combined with phosphoric acid or not, is thrown down. From the weight of the precipitate, that of the phosphoric acid present may be calculated, as both the amount of peroxide of iron present in the ash, and that which was added subsequently, are known.

A report is then given of the analysis of the ashes of barley, of the tubers of potatoes, of the bulbs of turnips, of hemp, of flax, and of beans, all cultivated in the Botanic Garden; and from the data thus obtained, the quantity of inorganic matters abstracted from the soil in ten years by the above crops is deduced; and a table is given showing the relation between the permanent and shifting crops, with respect to their produce, the amount of inorganic matters, that of alkali, and that of phosphates, contained in them.

In the third part of his paper, the author considers the chemical composition of the soil in which the above-mentioned crops were grown. He states, in the first place, the method he adopted for determining the amount of phosphoric acid present in the soil.

An analysis is then given of the soil taken from a portion of the garden contiguous to that in which the experiments were carried on, and from one of the plots of the garden itself; and from these data a calculation is made, that the ground at present contains enough phosphoric acid for nineteen crops of barley of the same amount as the average of those of the permanent crops, and of the same quality as that obtained in 1844. It was also found, that there was a supply of potass sufficient for fifteen crops of barley; of soda, for forty-five; and of magnesia, for thirty-four. When, however, we examine how much of these ingredients is taken up by water containing carbonic acid, the proportion of each is found to be much smaller; and a striking difference exists, in this respect, between the soil which had been recently manured and that which had been drawn upon by a succession of crops. In the first case, the quantity of alkaline sulphate obtained in the pound was 3·4 grs.; in the latter it varied from 0·7 to 0·07; and of phosphate, the quantity in the former was about 0·3, whilst in the latter it varied from 0·18 to 0·05.

From these facts the author concludes, first, that the falling-off of a crop after repetition depends, in some degree, on the less ready supply of certain of the inorganic ingredients which it requires for its constitution; but that two crops equally well supplied by the soil with these ingredients may take up different quantities of them, according as their own development is more or less favoured by the presence of organic matter in the soil in a state of decomposition.

Secondly, that it is very possible that a field may be unproductive, although possessing abundance of all the ingredients required by the crop, owing to their not being in a sufficiently soluble form, and therefore not directly available for the purposes of vegetation; so that, in such a case, the agriculturist has his choice of three methods; the first, that of imparting to the soil, by the aid of manure,

a sufficient quantity of these ingredients in a state to be immediately taken up; the second, that of waiting until the action of decomposing agents disengages a fresh portion of those ingredients from the soil (as by letting the land remain fallow); and the third, that of accelerating this decomposition by mechanical and chemical means.

Thirdly, that it is probable that in most districts a sufficient supply of phosphoric acid and of alkali for the purpose of agriculture lies locked up within the bowels of the earth, which might be set at liberty and rendered available by the application of the artificial means above alluded to.

Fourthly, that the aim of nature seems to be to bring into this soluble, and therefore available condition, these inorganic substances by animal and vegetable decomposition, and therefore that we are counteracting her beneficial efforts when we waste the products of this decomposition by a want of due care in the preservation of the various excrementitious matters at our disposal.

Fifthly, that although we cannot deny that plants possess the power of substituting certain mineral ingredients for others, yet that the limits of this faculty are still imperfectly known, and the degree in which their healthy condition is affected by the change is still a matter for further investigation.

Lastly, that the composition of various plants, as given in this paper, differs so widely from that reported by Sprengel and others, that we are supplied with an additional argument in favour of the importance of having the subject of ash-analysis taken up by a public body, such as the Royal Agricultural Society of England, possessed of competent means and facilities for deciding between the conflicting authorities, and supplying us with a more secure basis for future calculations.

May 29, 1845.

The MARQUIS OF NORTHAMPTON, President, in the Chair.

"On the Ashes of Wheat." By William Sharp, Esq., F.R.S.

The experiments recorded in this paper were undertaken principally with the ultimate view of ascertaining with exactness what quantity of inorganic matter is removed from the soil by the seeds of a crop of wheat. The author first inquires what is the average amount of the inorganic or incombustible portion of a given quantity of wheat; a question to which no satisfactory answer has yet been given. The result of the author's experiments is, that wheat yields, by slow combustion, a residue of from $1\frac{1}{2}$ to $1\frac{3}{4}$ per cent. He then proceeds to determine by experiment the degree in which this result is influenced by previous drying at different temperatures, varying from 230° to 260° Fahr., and finds that a heat of 245° is not sufficient to expel all the moisture contained in wheat; for while

the loss of weight is then about 8 per cent. by a heat of 260° , the amount of this loss is 10 per cent. When the heat is so great as to occasion decomposition, the saline matter contained in the wheat fuses, and a portion of the carbon becomes so entangled or firmly adherent to it, as to be incapable of separation by burning. Hence he recommends, in order to obtain greater uniformity in the results, that the wheat subjected to these experiments should be dried at a low temperature, such as that of a room in summer, and be allowed to remain a few days under its influence. The author tried the effect of the addition of nitric acid, with a view to save time by accelerating the combustion; but found that the results could not be relied upon when this plan was adopted, and he was therefore obliged to relinquish it. He next directed his inquiries to the ascertaining whether the quantity of inorganic matter was in proportion to the specific gravity of the grain, that is, to its weight per bushel; and this he found in general to be the case. The conclusion he deduces from this investigation is, that the mean amount of inorganic matter removed from the soil by the grain of a crop of wheat is exactly one pound per acre.

"On Benzoline, a new organic Salt-base obtained from Oil of Bitter Almonds." By George Fownes, Esq., F.R.S.

Pure oil of bitter almonds is converted, by the action of a strong solution of ammonia, into a solid white substance having a crystalline form, and which was termed by M. Laurent *hydrobenzamide*. The author found that this substance, by the further action of alkalis, became harder and less fusible than before, and not differing in chemical composition from the original substance, but exhibiting the properties of an organic salt-base. To this substance the author gives the name of *benzoline*. He finds that the salts which it forms by combination with acids are, in general, remarkable for their sparing solubility; and that many of them, as the hydrochlorate, the nitrate and the sulphate, are crystallizable. Of the properties of these salts the author gives a detailed account.

June 5, 1845.

Very Rev. DEAN OF ELY in the Chair.

"Electro-Physiological Researches." Memoir First. By Professor Carlo Matteucci. Communicated by Michael Faraday, Esq., D.C.L., F.R.S.

The author describes several arrangements by which he was enabled to make new experiments in confirmation of the laws of muscular currents, of which he has given an account in his recent work, entitled "*Traité des Phénomènes Electro-Physiologiques des Animaux*." He finds that, in these experiments, the employment of a galvanometer is unnecessary, as the sensibility of the electroscopic frog

of Galvani gives sufficient indications of the electric current without the use of that instrument.

The general results obtained from these experiments are the following.

In the first place, the intensity and duration of the muscular current is independent of the nature of the gas in which the muscular pile is immersed. Secondly, it is altogether independent of the cerebro-spinal portion of the nervous system. Thirdly, the circumstances which exercise a marked influence on its intensity are the conditions of the respiratory and circulatory systems. Fourthly, those poisons which seem to act directly on the nervous system, such as hydrocyanic acid, morphia and strychnine, have no influence on the nervous current. Fifthly, sulphuretted hydrogen has a decided influence in diminishing the intensity of the muscular current. Sixthly, the intensity of this current in frogs varies according to the temperature in which the frogs have been kept for a certain time during life; a result which, of course, is not obtainable with animals which do not take the temperature of the surrounding medium. Lastly, the intensity of the muscular current in animals increases in proportion to the rank they occupy in the scale of beings; and on the other hand, its duration after death is exactly in an inverse ratio to its original intensity. The author concludes by stating his belief, that the property of the muscles immediately connected with their electric currents, is identical with that which was long ago denominated by Haller *irritability*, but which is at present more usually designated by the term *contractility*. He ascribes the development of this muscular electricity to the chemical actions which are attendant on the process of nutrition of the muscles, and result from the contact of arterial blood with the muscular fibre. He conceives that in the natural state of the muscle, the two electricities thus evolved neutralise each other at the same points at which they are generated; while in the muscular pile contrived by the author, a portion of this electricity is put into circulation in the same manner as happens in a pile composed of acid and alkali separated from one another by a simply conducting body.

June 19, 1845.

RICHARD OWEN, Esq., V.P., in the Chair.

"On the Connexion between the Winds of the St. Lawrence and the Movements of the Barometer." By William Kelly, M.D., Surgeon R.N., attached to the Naval Surveying Party on the River St. Lawrence. Communicated by Captain Beaufort, R.N., F.R.S.

The author adduces a great number of observations which are in opposition to the generally received opinion, that the mercury in the barometer has always a tendency to fall when the wind is strong. During a period of fifteen years passed in the Gulf and River St.

Lawrence, he found that the barometer as frequently rises as falls under the prevalence of a strong wind; and that the winds often blow with greater force with a rising than with a falling barometer. He gives a circumstantial account of the progress and course of various gales which fell under his observation during that period, and from which he infers the existence of a steady connexion between the prevailing winds of this region and the movements of the barometer, and enters into an inquiry into the mode in which that instrument is affected by them. The extensive valley of the St. Lawrence is bounded at its lower part, for a distance of nearly 500 miles, by ranges of hills, rising on each side to a considerable elevation. Within this space, the ordinary winds follow the course of the river; and in almost every instance when they approach from windward, the barometer rises with them; and when, on the other hand, the wind approaches from leeward, the barometer not only falls before the arrival of the wind, but continues to fall until it has subsided.

An appendix is subjoined containing extracts from the tabular register of the barometer and winds at various points in the valley of the River St. Lawrence, during the years 1834 and 1835, accompanied by remarks on different points deserving notice in particular cases.

"On the Elliptic Polarization of Light by reflexion from Metallic Surfaces." By the Rev. Baden Powell, M.A., F.R.S., Savilian Professor of Geometry in the University of Oxford.

In a former paper, published in the Philosophical Transactions for 1843, the author gave an account of the observations he had made on the phenomena of elliptic polarization by reflexion from certain metallic surfaces, but with reference only to one class of comparative results. He has since pursued the inquiry into other relations besides those at first contemplated, and the present paper is devoted to the details of these new observations, obtained by varying the inclination of the incident rays, and the position of the plane of analysis, and by employing different metals as the reflecting surfaces. By the application of the undulatory theory of light to the circumstances of the experiments and the resulting phenomena, the law of metallic retardation is made the subject of analytic investigation. A polariscope of peculiar construction, of which a description is given at the conclusion of the paper, was employed in the experiments: and tables are subjoined of the numerical results of the observations.

"On the Gas Voltaic Battery. Voltaic Action of Phosphorus, Sulphur, and Hydrocarbons." By William Robert Grove, Esq., M.A., F.R.S., V.P.R.I., Professor of Experimental Philosophy at the London Institution.

The author, referring to a paper of his published in the Philosophical Transactions for 1843, states, that in repeating and verifying some of the experiments therein contained, he was led to those which

form the subject of the present memoir. With the form of gas battery last described in that paper, by which the interfering action of the external air is excluded, he finds that deutoxide of nitrogen associated with oxygen gives a continuous voltaic current; and that the volumes respectively absorbed by the electrolyte are as four to one, indicating the formation of hyponitrous acid.

Passing to the more immediate object of the present paper, he states that having observed nitrogen procured by the combustion of phosphorus to give rise, in the gas battery, to a temporary voltaic current, he was led to believe that phosphorus, although an insoluble non-conductor, might, by means of the gas battery, be made the excitant of a continuous voltaic current, analogous to the zinc element of an ordinary voltaic combination. This expectation was verified by experiments, a series of which is given; phosphorus being suspended in various gases and voltaically associated with oxygen. The experiments were continued during several months, and the results indicated the same consumption of phosphorus with reference to the oxygen, as would occur by the formation of phosphorous acid; the phosphorus being thus burned by oxygen at a distance. Phosphorus and iodine, both non-conducting solids, being each suspended in nitrogen in the associated tubes of a gas battery, give a continuous voltaic current, and are consumed in equivalent ratios. Sulphur, suspended in nitrogen and associated with oxygen, gives a voltaic current when fused. Other volatile electro-positive bodies, such as camphor, essential oils, æther and alcohol, when placed in nitrogen and associated with oxygen, gave a continuous voltaic current.

The author observes that the gas battery, which in his former experiments introduced gases, by the present experiments renders solid and liquid insoluble non-conductors the exciting constituents of voltaic combinations, and enables us to ascertain their electro-chemical relations: it also introduces the galvanometer as a test of vaporization.

A new form of gas battery is described, in which an indefinite number of cells are charged by the hydrogen evolved from a single piece of zinc; the oxygen of the atmosphere supplying the electro-negative element. The charge of the battery is self-sustained, in a manner somewhat similar to the Doebereiner light apparatus.

"The Blood-Corpusele considered in its different phases of development in the Animal Series." By Thomas Wharton Jones, Esq., F.R.S., Lecturer on Anatomy, Physiology and Pathology, at the Charing Cross Hospital.

This paper is divided into three parts: the first relating to the blood-corpuseles of the Vertebrata; the second to those of the Invertebrata; and the last to a comparison between the two. He first describes the microscopic appearances of these corpuseles in different classes of vertebrate animals, beginning with the skate and the frog, and proceeding to birds and mammifera; first in their early embryonic state, and next in the subsequent periods of their growth. He finds in oviparous vertebrata generally, four principal forms of

corpuscles. These he distinguishes as the phases, first of the *granule blood-cell*, which he describes as a cell filled with granules, disclosing by the solvent action of dilute acetic acid on these granules a vesicular, or as the author terms it, a "*cellæform*" nucleus. These granule cells appear under two stages of development, namely, the coarsely granulous stage and the finely granulous stage. The second phase is that of the *nucleolated blood-cell*, oval in shape, containing a vesicular (or "*cellæform*") nucleus, and red-coloured matter. These cells likewise appear under two stages of development; colourless in the first and coloured in the second, in which last stage it constitutes the *red corpuscle*. In the early mammiferous embryo, he finds, in addition to the former, a third phase, that of *free vesicular nucleus*, exhibiting, like the nucleolated cell, the colourless and the coloured stages.

On examining the corpuscles of the lymph of vertebrate animals, the author finds them in all the classes to be identical in structure with their blood-corpuscles, and differing only in the inferior degree of coloration attending their last stage. In the oviparous classes, he observes that the nucleolated are more numerous than the granule cells, while in the mammifera the latter are predominant, which is the reverse of the proportion in which they exist in the blood of these animals. He finds that some of the nucleolated cells of the contents of the thoracic duct exhibit a marked degree of coloration, and have an oval shape; thus offering a resemblance to the blood of the early embryonic state.

The blood-corpuscles of all the invertebrate animals in which the author examined them, present the same phases of granule and nucleolated cells as in the higher classes, except that in the last stage of the latter phase the coloration is very slight, but the vesicular nucleus is frequently distinctly coloured. As in the higher classes, corpuscles exist in different states of transition from the granular to the nucleolated form of cell. In some of the invertebrata, corpuscles are found which appear to be the nuclei of some of the nucleolated cells become free; and these the author considers to be abortions, rather than examples, of cells having attained their third phase of free cells. Corpuscles are also met with in these animals, in greater or less abundance, belonging to the lowest forms of organic elements, namely, elementary granules.

The comparison which the author institutes between the blood-corpuscles of the vertebrate and invertebrate divisions of the animal kingdom, tends to show that they in all cases pass through similar phases of development, except with respect to the last, or coloured stage of the nucleolated cell, which they do not attain in the lower classes of animals. He finds that the blood-corpuscles of the crab, according to an analysis made by Professor Graham, contain a sensible quantity of iron, perhaps as much as red corpuscles. He considers the corpuscles of the blood of the invertebrata, in as far as relates to the absence of nucleated cells, as resembling those of the lymph of vertebrate animals.

"On some peculiar modifications of the Force of Cohesion, with reference to the forms and structure of Clouds, Films and Membranes." By William Addison, Esq., F.L.S. Communicated by P. M. Roget, M.D., Sec. R.S.

In the course of his researches into the nature and origin of tubercles in the lungs, and into the physical properties of the secretions of the human structure, the author had occasion to notice various fibrous and membranous forms arising solely from physical agencies. On pursuing the inquiry, he observed a class of phenomena indicating some peculiar modifications of the force of cohesion. Thus he found that transparent liquid streams are visible when vapours or fluids mingle with one another, and also when solids are dissolving in a fluid; and that opaque deposits, assuming the appearance of clouds, form on those streams, rendering visible the lines of junction of two fluid or gaseous surfaces. A great number of experiments are described illustrating these general facts, which are afterwards applied to explain various phenomena of clouds, films and membranous formations, resulting from the operation of the different cohesive forces which are called into action, under a diversity of circumstances, when liquid or gaseous bodies are brought into mutual contact.

"On the formation or secretion of Alkaline and Earthy Bodies by Animals." By Robert Rigg, Esq., F.R.S.

From the results of a comparison made by the author of the weight of the ashes obtained from a quantity of bread, equal to that which was the sole food of two mice during thirty-eight days, with the weight of the ashes of their excretions during the same period, it appeared that the latter exceeded the former in the proportion of 1334 to 984. The amount of soluble salts was also found to be greater in the latter than in the former. From these data, the author infers that both alkaline and earthy bodies are formed out of their elements by the animal system, and found in their excretions.

"An Account of the Observation of the total Eclipse of the Sun on the 21st of December 1843." By Lieutenant J. O. E. Ludlow, E.I.C. Engineers, Superintendent of the Magnetic Observatory at Madras. Communicated by J. C. Melville, Esq., F.R.S., Secretary to the Hon. the Court of Directors of the East India Company.

The author reports the results of his observation of the eclipse, which was unfortunately much interrupted by the passage of clouds; and he has also taken the opportunity of making observations on the Magnetic Dip and Horizontal Intensity at certain places on his journey.

"On the Barometrical Variation as affected by the Moon's Declination." By Luke Howard, Esq., F.R.S.

In this paper, which is a continuation of that which was published in the Society's Transactions for 1841 (p. 277), and in which the

average results of the author's observations extended only from the year 1815 to 1832, similar records of calculated averages are given down to the year 1841, and a comparison drawn with those of the former period. The author places the whole of these data in the hands of the Royal Society, for the purpose of being made the basis of future inquiry, in what he terms "the nascent science of Meteorology."

"Contributions to the Chemistry of the Urine; on the variations in the Alkaline and Earthy Phosphates in the healthy state, and on the Alkalescence of the Urine from fixed Alkali." By Henry Bence Jones, M.A. Cantab., Licentiate of the Royal College of Physicians.

The author, having observed that in some states of disease there occurs in the urine a great excess of the earthy phosphates, was induced to investigate the subject; and as a preliminary inquiry, to ascertain the variations in the amount of these phosphates at different times in the same person in a state of health, and to trace the causes which determine an excess or a deficiency of these salts in the urine; noting, at the same time, the variations in the quantity of the alkaline phosphates contained in it, with a view of discovering whether these variations are influenced by the same, or by different causes. The principal results to which his experiments have conducted him are the following. The quantity of the earthy phosphates in the urine voided soon after taking food is considerably greater than in that voided at other times; and this happens whether the meal consists of animal food or of bread only. After long fasting, the proportion of earthy phosphates is considerably diminished. On the other hand, the alkaline phosphates are present in greatest quantity when the food consists of bread alone: when meat alone is taken, the deficiency in those salts is still more marked than the excess in the former case. Exercise occasions no change in the quantity of the earthy phosphates, but causes an increase of nearly one-third in the amount of alkaline phosphates; but its influence is, on the whole, less than that of diet. The earthy phosphates are increased in quantity by chloride of calcium, sulphate of magnesia, and calcined magnesia taken into the stomach.

The author next examines the conditions in which the urine is alkaline, and which he considers to be of two kinds; the one, long known as *ammoniacal*, and arising from the presence of carbonate of ammonia; and the other, which has not hitherto been distinctly recognised, arising from fixed alkali, and appearing most frequently in urine secreted during a period of from two to four hours after breakfast, in persons suffering only from defective digestion. Under these circumstances, it may be, when voided, either turbid from amorphous sediment, or clear and alkaline when tested, or free from deposit and slightly acid. If in either of these last cases it be heated, an amorphous precipitate falls down, which is soluble in dilute hydrochloric acid, or in a solution of biphosphate of soda. Healthy urine may at any time be made to yield a precipitate of earthy phosphates by heat, even though it be acid, by having a portion of this

acid neutralised by any alkali, or by phosphate of soda, the fluid becoming more acid when boiled. A solution of earthy phosphates in biphosphate of soda also gives a precipitate on boiling, if some of its acid reaction is removed by any alkali. The fluid when boiled becomes more acid to test-paper, indicating the formation of a more basic earthy phosphate. A result precisely similar is obtained when common phosphate of soda, phosphate of lime, and a little biphosphate of soda exist together in solution; and by varying the quantities of each of these substances, the various phenomena which the urine occasionally presents may be imitated. The time at which the alkalescence of the urine from fixed alkali generally occurs, indicates the existence of some alkaline phosphate, or of some carbonated alkali in the food.

"On the Nerves of the Uterus." By Thomas S. Beck, Esq. Communicated by Sir Benjamin C. Brodie, Bart., F.R.S.

The object of the author in this communication is to record the results of his dissections of the nerves of the uterus, both in the unimpregnated and gravid states, with a view to determine if any changes are observable in them in these two conditions. He enters minutely into the anatomical details of the formation of the great splanchnic nerve, the composition of the semilunar ganglion, and the distribution of the branches proceeding from it to the different abdominal viscera. His conclusions are, that while the ovaria derive their nerves from the renal, the fallopian tubes from the hypogastric, and the bladder, rectum and vagina from the pelvic plexus, the nerves supplying the uterus are continuations of the hypogastric plexus, and that they undergo, during pregnancy, no further change, either in size or position, except that which is the simple consequence of the enlargement of the organ over which they are distributed, and that they undergo no other change during a second pregnancy. He thinks it probable, moreover, that the vessels of the uterus do not decrease in size after parturition, but are only contracted in their cavity. He notices several points relating to these subjects, which are still open to further investigation. The paper is accompanied by highly finished drawings of the appearance of the dissected parts.

"On a Peculiar Source of Deterioration of the Magnetic Powers of Steel Bars." By William Sturgeon, Esq. Communicated by S. Hunter Christie, Esq., Sec. R.S.

The author concludes, from various experiments on the changes in the magnetic force of steel magnets produced by subjecting them to blows with a wooden mallet, or other modes of creating tremors or vibrations among their particles, that the most apparently trifling mechanical agitation is sufficient to occasion a considerable diminution of magnetic power; that this loss, when it has taken place from such a cause, is permanent; and that in every case, after reaching a certain point, it attains its maximum, a fact which implies, in every magnet, the possession of a specific retentive force, of which it cannot be deprived by any further mechanical commotion of its parti-

cles. The more highly a bar is magnetized, the more it becomes susceptible of a loss of power by agitation.

"An Account of a Protracting Pocket Sextant." By Colonel Bainbridge. Communicated by P. M. Roget, M.D., Sec. R.S.

The object of the invention here described is to facilitate and expedite the making of sketches and surveys for military purposes on actual service, and by serving at once as a sextant and protractor, so that as soon as an angle is taken, it may at once be laid down on paper by employing the two legs of the instrument as rulers. A description referring to a diagram is given of this portable sextant.

"Observations on the Growth and Development of the Epidermis." By Erasmus Wilson, Esq., F.R.S., Lecturer on Anatomy and Physiology in the Middlesex Hospital.

The author adduces evidence derived from his microscopic observations, in confirmation of the commonly received doctrine respecting the origin of the cells of the epidermis and epithelium generally, from the materials furnished by the liquor sanguinis or plasma of the blood; which fluid, passing by endosmosis through the walls of the capillary vessels and peripheral boundary of the surface, develops granules by a vital process, analogous to coagulation. On a careful examination of the inner surface of the epidermis with the aid of the microscope, he finds it to be composed of four kinds of elements, arranged in such a manner as to constitute an irregular plane, similar to a tessellated or mosaic pavement. These elements are,—1. *Granules*, which the author terms *primitive*, of a globular form, solid and apparently homogeneous, and measuring about 1-20,000th part of an inch in diameter. 2. *Aggregated granules*, having about double the diameter of the former and apparently composed of as many of these as can be aggregated together without leaving an unoccupied space in the centre of the mass. 3. *Nucleated granules* measuring in diameter from the 6000th to the 4000th part of an inch, each being composed of an aggregated granule as a nucleus, enveloped by a single layer of aggregated granules, giving to the whole mass an oval or circular, and at the same time flattened shape. Their constituent granules have acquired, during this aggregation, greater density, and are separated from each other by distinct interstitial spaces filled with a transparent homogeneous substance. 4. *Nucleolo-nucleolated* cells pervading the deep stratum of the epidermis, and of which the longer diameter measures from the 3000th to the 2500th part of an inch. These cells, which constitute the principal portion, and may be regarded as the chief constituent of the epidermis, are formed from the nucleolated granules, on the exterior of which there is superposed a transparent layer, bounded by a well-defined outline, by the dark interstitial substance of the wall of the cell; the nucleolated granule being the nucleus, and the aggregated granule the nucleolus of these primitive cells of the epidermis. The author is of opinion that the nuclei, up to a certain point, grow with the cells, by the separation of the original granules from the deposi-

tion between them of interstitial matter, and also by the cleavage of the latter and the consequent multiplication of the granules. This peripheral growth of the cells is totally different from the mode of growth described by Schwann, and explains the disappearance of the nucleus in the scales of the epidermis. The observations of the author lead him to believe that the same process of development and of growth is followed in the epithelium as in the epidermis; and he offers evidence, showing that similar arrangements take place in the cells of melanosis, in the pigment cells of the choroid membrane of the eye, and in those of the skin of the negro.

"On the Temperature of Man." By John Davy, M.D., F.R.S. L. & E.

Having in a former paper shown that, contrary to a commonly received opinion, the temperature of the human body, as measured by a thermometer placed under the tongue, is not a constant one, the author has resumed the inquiry, and gives, in the present paper, the results of numerous observations made with a particular instrument constructed for the purpose, admitting of minute accuracy (each degree of the scale being divided into ten parts), and when used with the precautions pointed out, affording satisfactory indications in many problems which may be proposed relative to the temperature of man, &c., and confines himself to a small number, offering the information he brings forward only as a preliminary contribution in aid of their solution.

The paper is divided into seven sections.

The first treats of variations of temperature during the twenty-four hours. The author finds from his observations, that the temperature is highest in the morning, on rising after sleep; that it continues high, but fluctuating, till the evening; and that it is lowest about midnight, ranging on an average from 98.7 to 97.9.

The second, of variations during the different seasons. These, he finds, bear some relation to the temperature of the air, but less than might be expected; which he attributes to the majority of the observations having been made within doors, under circumstances peculiarly favourable to uniformity.

The third, of the influence of active exercise on the temperature. The effect of this, when not carried to the length of exhausting fatigue, he finds to be elevating; and that the augmentation is, within a certain limit, proportional to the degree of muscular exertion.

The fourth, of passive, such as carriage exercise. The effect of this in a cool air, contrary to that of quick walking or riding, would appear to be lowering.

The fifth, of abstinence from all exercise in a cold atmosphere. This he finds to be depressing in a still greater degree; sitting in a cold church has occasioned a reduction of temperature from 1° to 2°, the air of the church being from 42° to 32°.

The sixth, of sustained attention or exertion of mind. This would appear to have the effect of raising the temperature, but in a much less degree than bodily exercise.

The seventh, of taking food. It would appear that a light meal, such as breakfast, alters very little the temperature, whilst a heavy meal, such as dinner with wine, tends to lower it.

The conclusion drawn by the author from his observations, considered in their greatest generality, is, that the temperature of man is constantly fluctuating within a certain limit; regularly during the twenty-four hours; and irregularly according to the operation of certain disturbing circumstances.

Should multiplied observations give similar results, he infers that they will admit of many applications, both as regards the regulation of clothing, the warming of apartments, and possibly the prevention and cure of diseases,—conducive alike to increase of comforts and health.

Tables are appended, containing a series of observations extending through eight months, in which not only the temperature of the body is noticed, but also the frequency of the pulse and of respiration, and the temperature of the air.

"On Ozone." By C. F. Schoenbein, Professor of Chemistry at Basle, in a letter to Michael Faraday, Esq., D.C.L., F.R.S. Communicated by Michael Faraday, Esq.

The author finds that the peculiar substance he has denominated *ozone*, and which, reverting to the opinion he originally entertained, he now believes to be a compound of oxygen and hydrogen, is obtained readily and in great abundance by placing phosphorus in immediate contact with water and atmospheric air at a temperature of about 30° Cent., but that none is produced when water is absent. Heat was found to effect the decomposition of ozone. He infers, both from his own experiments and those of M. Marignac, that the presence of nitrogen, instead of being essential to the formation of ozone, as he formerly believed, does not in reality contribute in any way to the production of that substance.

"On the Theory of Vision," in a letter to S. Hunter Christie, Esq., Sec. R.S. By William Ford Stevenson, Esq., F.R.S.

The author adduces two experiments, of placing before the eye an object, the ends of which are marked, in a vertical position, as "clearly demonstrating that objects are not presented to the mind as they are found upon the retina, but in the actual position in which they are placed before the spectator."

"On the Compounds of Tin and Iodine." By Thomas H. Henry, Esq. Communicated by Richard Phillips, Esq., F.R.S.

Different properties have been assigned by different authors (as Sir Humphry Davy, Gay-Lussac, Boullay and Rammelsberg) to a combination of tin with iodine. With a view to explain these discordances, the author instituted the series of experiments detailed in this paper, and which have led him to the conclusion that the substance obtained by heating tin with twice its weight of iodine is a mixture of two salts, differing from each other in their composition.

One of these is soluble in water to a slight extent without suffering decomposition, while the other is immediately decomposed on coming into contact with water; the former being the real proto-iodide described by Boullay, and the latter being a biniodide, a salt of which no particular description had hitherto been given, but which was probably the compound noticed by Sir Humphry Davy as being of a brilliant orange colour. The author found that this biniodide sublimes at a temperature of 356°F. , while the proto-iodide, if protected from the contact of air, may be heated to redness without subliming. The author did not succeed in obtaining a combination of tin and iodine corresponding to the sesquioxide, although Boullay supposes that such was the composition of some yellow crystals which were formed by the mixture of solutions of proto-chloride of tin and of iodide of potassium. A more detailed account of the properties of the iodides of tin is reserved for a future communication.

Supplement to a Paper "On the Nervous Ganglia of the Uterus." By Robert Lee, M.D., F.R.S., Fellow of the Royal College of Physicians.

The author is confirmed in his views regarding the arrangement of the nervous filaments distributed to the uterus, as described in his papers printed in the Philosophical Transactions for 1841 and 1842, by his recent dissection of a gravid uterus at the full period, and which he considers as demonstrative of the accuracy of all the statements which are contained in those communications.